

"2. *Dutch or Batavian nutmegs.* These are limed nutmegs. In London they scarcely fetch so high a price as the Penang sort.

"3. *Singapore nutmegs.* These are a rougher, unlimed, narrow sort, of somewhat less value than the Dutch kind. According to Mr. Oxley, 4,085,361 nutmegs were produced in Singapore in 1848, or about 252 piculs (of 133½ lbs. each), but the greater number of trees had not come into full bearing; and it was estimated that the amount would in 1849 be 500 piculs."

The *long or wild nutmeg* is also met with in commerce.
Mace of two kinds is found in the market, the *true* and *false*.
Of the the true maces, there are the following varieties:—

- 1. Penang mace. This fetches the highest price. It is flaky and spread. The annual quantity produced in Penang is about 130 piculs (133½ lbs. each).
- 2. The Dutch or Batavian mace.
- 3. The Singapore mace.

The wild or false mace is devoid of aromatic flavour.
The uses of nutmegs and mace in dietetics are well known; an essential oil of nutmegs (*Oleum myristicæ*), is obtained by submitting water and nutmegs to distillation.

In 1857 and 1858 our importations of nutmegs and mace were as follows:—

P.C.4

	1857. lbs.	1858. lbs.
Holland	10,165	28,341
Java	18,739	22,055
United States	18,826	
British East Indies	394,984	372,077
British West Indies	6,147	4,085
Other parts	6,111	227
	462,972	421,785

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Of these, in 1857, 101,061 lbs., and in 1858, 232,834 lbs., were entered for home consumption.

	1857. lbs.	1858. lbs.
Holland	950	2,233
Sumatra	1,286	
Java	5,789	7,341
Philippine Islands	1,338	
British East Indies	105,099	83,341
British West Indies	949	443
Other parts	832	691
	116,283	93,924

Of this quantity, in 1857, 24,176 lbs. and in 1858, 29,549 lbs. were entered for home consumption.

NUTMEG, BUTTER OF. See OILS.
NUT-GALLS. See GALL-NUTS.
NUT OIL. An oil professedly obtained from walnuts, which is thought to be superior to the best linseed oil for delicate pigments; when deprived of its mucilage it is pale, transparent, and limpid. See OIL.

NUTRITION, or the process for promoting the growth of living beings, occupies a most important position in the study of physiology, and in the important practical question of health. In some of the more succulent plants we observe that they increase in volume after detachment from their parent soil, by the absorption of the nutriment which they find in the atmosphere, viz. oxygen, vapour of water, carbonic acid, and ammonia. But all these are gaseous bodies or vapours, while the plant itself is a solid. Hence we infer that such a plant is capable of reducing gases to a solid form, and of thus increasing in bulk and weight. It appears that all plants are similarly endowed, and that they mainly subsist by feeding on the gases which surround them, by converting these elastic fluids, assisted by the elements of the soil, by means of the organs with which they are supplied, into the solid forms of the vegetable kingdom, so endless in figure, but yet so lovely that the greatest familiarity only renders them objects of superior admiration. When we turn to the animal world we find that the individuals of which it is composed are incapable of con-

densing gases. The least educated person knows that animals cannot subsist on air, but that they require to imbibe solid matter, which, by research, it has been found must be similar to that of which they themselves consist. Hence an animal may be defined to be, a being which subsists by appropriating to itself food similar to the matter of which its own body is composed. A reason is thus found for its locomotion; while a plant finding its nourishment in the air in which it is immersed has its food brought to it by the usual laws of inanimate nature. In some of the lower parts of the animal scale it has been found that matter exists (cellulose) identical with that supposed to be peculiar to vegetables, and hence it may be probable, that, as nature is simple in her works, the animated world consists of a chain, formed of a series of beings, passing down in regular gradation, from comparatively the most perfect to the most imperfect state; the lowest plant being closely allied to the lowest form of animal. If this be so, it will at once be obvious, that to say where plants begin and animals end, cannot be a problem of easy solution. But even in the higher classes of animals substances usually considered characteristic of vegetable life have been recently believed to have been detected. But the occurrence of such materials in the animal structure upon a limited scale, might be possibly accounted for by processes of reduction, so peculiarly the distinguishing feature of the chemistry of animals, rather than by constructive means, such as denote the result of vegetable activity.

The determination of the proper food for animals is a great experiment, and must be guided by the light of science. In reference to the human race, we must carefully study the habits and the results of the instinct of the inferior animals subsisting on similar aliment. For it is evident that there are certain laws which naturally regulate the lower beings in the choice of their food. It would be a phenomenon to hear of the suicide or accidental death, from choice of food, of a domesticated animal, still more so, of that of a creature which is free to roam amid the wild scenes of nature. We can recall but an isolated case of the failure of animal instinct with regard to the selection of food. It was in the instance of a pony which swallowed a quarter of an ounce of dried and powdered monkshood (*Aconitum napellus*). The animal suffered considerably, as if under an attack of glanders, for a few hours. But these occurrences are so rare, that it might almost be affirmed, that man is the only created being which disobeys the laws of nature. It is merely when domesticated, and under circumstances analogous to those in which man himself is placed, that we find the inferior creation imitating, by such experiments, the example of their more godlike superiors.

The consideration of the subject of nutrition comprehends the nature of nutriment or food, and of its change into blood, and into the solids and fluids of the animal structure. Food is required in proportion to the wear and tear of the body. The waste which the animal system thus undergoes varies with the age and the labour to which the animal is subjected. Hippocrates knew that children are more affected by abstinence than young persons; these more than the middle-aged, and the latter more than old men. In conformity with this observation, Dante has framed the stirring incidents in the story of Count Ugolino, a nobleman of Pisa, who was confined, with his four sons, in the dungeon of a tower, the key of which being cast into the river Arno, they were, in this horrible situation, starved to death. On the fourth morning, the youngest child "sunk in death," while the others followed "one by one." From the history of the slave traffic we learn that many of the poor Africans, torn from their country and friends, often prefer death in various forms to a life of bondage. Some of them have been known to starve themselves to death; and in two cases, in which the details are graphically supplied, the pains of the sufferer were terminated "in eight or ten days," while in the other case the mortal scene was closed on the ninth day. (*Dr. Trotter, Mr. Wilson, 1790, Parliam. Com.*) An interesting incident has been recorded of a North American Indian, the last of his tribe, which had been thus almost extinguished by small-pox. He resolved to die; and, abstaining from all nutriment, perished on the ninth day. (*Cutlin.*) In order to study the nature of the process of nutrition, we are obliged to take advantage of all the avenues to knowledge which present themselves, in viewing the animal system. One of the readiest means seems to be, to ascertain how, without the use of food, the built-up animal loses weight, languishes, and dies, under the conditions of inanition; and for this purpose we have too frequent opportunities among the children of the poor in ill-ventilated, lowly dwellings; or we may experiment upon an inferior animal, ascertain daily its loss of weight by absence of nutriment, and after the lapse of a sufficient period, feed it with aliment carefully analysed. The gradual change in the weight occasioned by the passage of the food from the stomach into the circulation, is then to be watched, and the further influence on the system by its disappearance in the form of excretions, and of expiration by the lungs and skin. Death is occasioned in the instances related, by starvation, as it is termed in common

language. In other words, the oxygen which a human being is compelled to introduce into his lungs daily, to the extent of $32\frac{1}{2}$ ounces, combines with the carbon and hydrogen of the solid tissues of the body, to be expired in the form of carbonic acid. The amount of carbon actually consumed has been found to be $13\frac{9}{10}$ ounces. The consumption of the carbon and hydrogen in each animal must depend on the oxygen introduced by respiration. Hence the child, as in the tragedy of Dante, whose respiratory organs are in great activity, requires a more frequent supply of food, and in greater abundance than an adult. A bird deprived of food, dies on the third day; — while, a serpent — which, when confined in a bell jar of air, consumes in an hour so little oxygen that the carbonic acid formed is inappreciable — can live without food for three months or longer. (*Liebig.*) It has been found that turtle-doves, when kept without solid food for seven days, lost 4·12 per cent. of their weight, and 2·696 per cent. of carbon by respiration, having exhaled daily 3·722 per cent. when fed on millet; the excrements weighed ·21 per cent. of the weight of the body. (*Boussingault, Ann. Chim.* 3 sér. 11, 433.) Other researches have shown that mammalia lose daily in starvation 4 per cent., birds, 4·4 per cent.; thus affording a mean of 4·2 per cent. of their weight. (*Chossat.*) A cat, weighing about 90 ounces (2572 grammes), died on the eighteenth day of starvation, losing daily 2·87 per cent. of its weight; the total loss being 51·7 per cent. of its weight. (*Bidder and Schmidt.*) The deductions which have been made from this experiment are that the cat lost 1264·8 grammes of its weight, which consisted of 200·43 grammes of muscle, 132·75 grammes of fat, and 927·62 grammes of water. In another experiment, a cat weighing 3047·8 grammes had injected into its stomach daily 150 grammes of water. The trial was continued for a week, during which the animal lost 438 grammes, or 62·57 grammes daily, a less diminution of weight than when no water was supplied; and hence we can understand, in some measure, the facts which have been detailed of protracted cases of starvation under the influence of water. Of the different parts of the body which relatively sustain diminution of weight in these instances, it appears that the blood undergoes the greatest loss, or about 93·7 per cent. of its weight during the 18 days, the pancreas 85·4 per cent., the fatty tissue 80·7 per cent., muscles and tendons 66·9 per cent., brain and spinal cord 37·6, bones 14·3 per cent., kidneys only 6·2 per cent. of each of their original weights. Hence the loss of weight in starvation is chiefly experienced in the muscles, the blood, and the fat. Half of the loss may be referred to the muscular tissue, a quarter to the fat, and the remaining quarter to all the other organs. It seems to be principally the products of decomposition of the muscles, and of the fat, which are represented in the excretions. With reference to the form in which these portions of the animal frame disappear from the system in the excretions and exhalations, it appears that the daily loss of muscle undergone by an animal was ·611 per cent. of its weight, while the fat was ·422 per cent. These yielded 2·16 per cent. carbonic acid, 1·6 per cent. of aqueous vapour through the skin, ·20 per cent. of urea in the urine, ·008 per cent. sulphuric acid, ·001 per cent. of phosphoric acid, ·029 per cent. inorganic constituents of the urine, ·080 per cent. dry fæces (including ·02 per cent. of bilious matter), and 2·24 per cent. of fluid water removed with the urine and fæces. (*Op. cit.*) Such is the elucidation, so far as it has been carried by experiment, of the results of starvation, and of the nature of the products which, by the influence of the atmosphere, are thrown off from the animal system. The next object of interest which has attracted attention, has been the increase of an animal in weight and bulk. An experiment on a cat, weighing 2177 grammes, has shown that the animal in eight days consumed 1886·7 grammes of flesh, 27·4 grammes fat, and increased in weight by 337 grammes. During the experiment, 62·36 grammes of nitrogen were eliminated by the urine. It was calculated that the increase in weight depended partially on the deposition in the system of 40·16 grammes of muscular matter from the food of 143·42 grammes of fat, 178 grammes salts with sulphur, and 134·15 grammes water. Such researches being made with pure animal matter as food, it is easy to perceive that the increase of the animal depends on the simple assimilation or deposition of the animal matter already formed; but when an animal becomes fat by the consumption of vegetables, the question of the origin of the muscle and fat from such a source becomes a legitimate subject of discussion. The nitrogenous matter of vegetables has now been identified with similar bodies found in animals, and therefore we can readily account, for the supply of the waste of muscle, by the assimilation of nitrogenous vegetable food. The origin of the fat in animals fed on the produce of plants is not so obvious.

John Hunter had long ago, in his admirable observations on bees, found (*Phil. Trans.* vol. lxxxii. 128, 1792) that these creatures collect farina or pollen, deposit it at the bottom of their cells, and that other bees knead it and “work it down into the bottom,” or spread it over what was deposited there, before converting it into the consistence of paste (bee bread); this he discovered in the interior of the maggots; he

therefore infers that it is the food of this early condition of the bee, and is not intended "to make wax." The bees when caught returning home, were found with the fine transparent terminal gullet-bag full of honey. When examined on going out in the morning this bag was empty, from which Hunter concluded that the honey was either regurgitated for preservation as future aliment, or passed into the stomach. He shows that the bee bread is not wax, and concludes that "the wax is formed by the bees themselves; it may be called an external secretion of oil, and I have found that it is formed between the scales of the under side of the belly." On examining the bees through glass hives while they were climbing up the glass, he could see that most of them had this substance, for it looked as if the lower or posterior edge of the scale was double, or that there were double scales, but he perceived it was loose, not attached. Finding that the substance brought in on their legs was farina, intended, as appeared from every circumstance, to be the food of the maggot, and not to make wax, and not having yet perceived anything that could give the least idea of wax, he conceived these scales might be it, at least he thought it necessary to investigate them, and therefore took several on the point of a needle, and held them to a candle, when they melted and immediately formed themselves into a round globe; on which he no longer doubted that this was the wax, which opinion was confirmed by not finding those scales but in the building season (*ib.*). It is a remarkable circumstance that foreign chemical physiologists who have interested themselves in this question, and who have merely confirmed Hunter's observations, omit to mention even his name, while they notice that of Huber, a subsequent inquirer.

But that the oil of the food is incapable of supplying the fat of the animal, or of the butter of milk, is clearly established. One of the earliest experiments on this subject may be cited:—two cows were found to have, in the total food consumed, 10·094 lbs. of oil and wax, while the butter of the milk amounted to 72·26 lbs., and the oil and wax in the dung was 52·5 lbs.; showing an excess of 23·82 lbs. of oil in the butter and dung over what originally existed in the food. The conclusion is inevitable that starch and sugar, assisted by the nitrogenous matter, must have yielded fatty material. — *R. D. Thomson, Trans. Med. Chirurg. Soc., 1846, vol. xxix.*

According to the present views of those best acquainted with this subject, the non-nitrogenous food is that which is especially destined for the production of animal heat, the oxygen of the air yielding heat when it unites with its carbon and hydrogen. "The heat which is produced by respiration is similar to that which is produced by the inflammation of combustible bodies, with this difference, that in the latter instance the fire is separated from the air, in the former from the blood." (*Adair Crawford's Exper. on Animal Heat, 1779, p. 76.*) It is to Crawford that the theory of animal heat is usually attributed. The French claim the honour for Lavoisier. There is no doubt that the latter was engaged with the subject about the same period, but the date of his publication is doubtful, as at that period French writings were usually ante-dated. The doctrine of animal heat, as originally suggested by Crawford, still stands its ground. All the arguments opposed to it are merely trifling attacks upon little indentations in the great curve, which expresses the average theory. When we compare the staple articles of food with the blood, we shall find in the latter fluid corresponding bodies to those constituting the nutriment, as appears in the following parallel columns:—

	Milk.	Flour.	Blood.
		Fibrin.	Fibrin.
		Glutin.	
Nitrogenous matter - -	Casein.	Casein.	Casein.
	Albumen.	Albumen.	Albumen.
			Globulin.
			Colouring matter.
Non-Nitrogenous matter -	Butter.	Oil.	Fats and oils.
	Sugar.	Starch.	Sugar.
	Chloride of potassium.		
	" of sodium.		
	Sulphate of soda.		
Salts - -	Carbonate of soda.	Ditto	Ditto.
	Phosphate of soda.		
	" of lime.		
	" of magnesia.		
	" of iron.		

Law of the Balance of the Food.—The older opinions respecting the nature of nutrition seems to have been that the stomach and digestive organs possessed the power of assimilation, as it was termed. Although this expression might still be used in a restricted sense, the former meaning, which was attached to it, was of a much more extensive nature, and implied a power in the animal system which we now

know is not possessed by it. Indeed a comparatively slight acquaintance with medical writers, up to even a recent date, is sufficient to teach us, that a belief existed, that almost any species of organic matter, when subjected to the assimilating powers of digestion, could be rendered serviceable in the support of the body. The great discovery of Beccaria in 1742, in his analysis of flour, ought to have produced a greater revolution in dietetics than it appears to have done. He first observed, that if wheaten flour be washed with water on a sieve, the water becomes milky by the mechanical diffusion of the starch, which in time subsides, while a material like glue, which is not miscible with water, remains. He termed the portion carried away by the water starch, and the soft tenacious residue he denominated gluten (now known to consist of fibrin, gluten, casein). He identified the starch with vegetable matter, while the glutinous portion appeared to be endowed with the character usually attributed to animal matter, and this led him to propose two very simple tests by which the vegetable and animal substances, that is matters containing nitrogen, may be readily discriminated. When vegetable, or non-nitrogenous bodies are digested in water, they do not putrefy, but ferment and yield as a product a vinous or an acid fluid. With these starch corresponds. Animal substances, on the other hand, under the same conditions, putrefy and corrupt, and afford an urinous or ammoniacal fluid. Again, distillation supplies a valuable distinguishing test of the products of the two kingdoms. Vegetable or non-nitrogenous matter, when subjected to this operation, yields an acid product, and a heavy black oil, similar to pitch. Such are the characters of starch. Gluten, like animal or nitrogenous bodies, affords an alkaline spirit — a volatile alkaline salt (carbonate of ammonia), first a yellow, then a black oil, and finally there is left by intense heat, a black spongy matter (charcoal), which in an open fire becomes a white insoluble earth (bone earth). These remarkable observations struck Beccaria with surprise, as he found no traces of any such results in previous writers. For when he had discovered gluten by the simple process already detailed, it appeared to him so identical with animal matter that, if he had not himself extracted it from wheat, he should have mistaken it for a product of the animal world. (*Hist. de l'Acad. de Bologne. Collect. Acad. x. 1.*) These views, which are in exact consonance with the most recent ideas entertained by chemical physiologists, appear to have produced little fruit, although the question put by the author, "Are we composed of other substances than those which serve for our nourishment?" distinctly exhibits the view which he took of the subject. During the present century, a large amount of experiment has clearly demonstrated that animals cannot subsist on starch, sugar, or other foods destitute of nitrogen; and therefore the inference was fairly deduced that the animal system possessed no power of assimilating nitrogen from the air. (*Magendie.*) Further consideration led to the conclusion that milk constitutes the type of what nutriment should be, since it is supplied for animal support by nature at the earliest period of human existence (*Prout*), and contains nitrogenous matter, oil, and sugar. Afterwards experiments were made to determine the amount of nitrogen in food, and the relative value of nutriment was tabularly stated, in dependence on the ratio of nitrogen present in each species (*Boussingault, Ann. de Chim. lxiii. 225, 1836*), a method which has been superseded. It was subsequently inferred that nitrogenous matter supplied the waste of the muscular tissue, while the non-nitrogenous constituents of the food served for respiratory purposes, or the production of animal heat by obviating the too rapid transformation of the muscular elements of the body. (*Liebig, Organische Chemie, 1842.*) This was the true key to the solution of the problem as to the function of the nitrogenous and non-nitrogenous food, and it laid open a wide field for inquiry in reference to the application of rational systems of dieting to the animal system. For example, it was found in a series of experiments conducted for the British Government in 1845, that in a stall-fed cow in one day, taken from an average of several months, the amount of food conveyed into the circulation of the blood of the animal, was 14.56 lbs. weight, and when the nature of this mass of nutriment was subjected to chemical inquiry, it appeared that 1.56 lbs. consisted of nitrogenous matter, and 13 lbs. of non-nitrogenous food. When the relation between these two quantities is calculated, it results that the nitrogenous is to the non-nitrogenous food as 1 to 8.33, in the case of an animal at rest. This observation led to researches into the relative constitution of food as employed by different nations; and the deduction was made, that it is a law of nature, that animals under the different conditions of rest and exertion, require food in which the relation of the nutrient or nitrogenous food is different in reference to the non-nitrogenous or heat-producing (calorifiant) constituent: — that the animal system may be viewed, as, in an analogous condition to a field, from which different crops extract different amounts of matter, which must be ascertained by experiment; — an animal at rest consuming more calorifiant food, in relation to the nutritive constituents, than an animal in full exercise. From the analyses then instituted the following table was constructed.

Approximate relation of nutritive or nitrogenous to calorifiant matter.—

								Relation of Nutritive to Calorifiant Matter.
Milk food for a growing animal	-	-	-	-	-	-	-	1 to 2
Beans	-	-	-	-	-	-	-	1 „ 2½
Peas	}	-	-	-	-	-	-	1 „ 3
Linseed		-	-	-	-	-	-	
Scottish oatmeal		-	-	-	-	-	-	1 „ 5
Wheat flour	}	-	-	-	-	-	-	1 „ 7 to 1 „ 8
Semolina		-	-	-	-	-	-	
Indian corn		-	-	-	-	-	-	
Barley		-	-	-	-	-	-	
Potatoes		-	-	-	-	-	-	1 „ 9
East Indian rice		-	-	-	-	-	-	1 „ 10
Dry Swedish turnips		-	-	-	-	-	-	1 „ 11
Arrowroot	}	-	-	-	-	-	-	1 „ 26
Tapioca		-	-	-	-	-	-	
Sago		-	-	-	-	-	-	
Starch		-	-	-	-	-	-	1 „ 40

These proportions will consequently vary considerably according to the richness of the grain or crop, and hence similar tables which have been subsequently published by others will be found to differ in some of the details from the preceding data; but the facts now stated—given as approximate—are probably as good averages as could be selected.—*R. D. Thomson, Medico-Chirurgical Trans.* xxix. and *Ex-perim. Researches on the Food of Animals*, 1846, p. 162.

A consideration of the nature of the relations exhibited in this table is sufficient to afford an explanation of many practical results in the subject of diet. Thus in the young of the mammalia,—including the human race,—the heat-forming or non-nitrogenous food, is only two or three times greater than that of the nitrogenous food which is the supporter of the muscular tissue of the body, because the child requires a larger amount of matter to repair its daily waste, and likewise an additional portion to enable it to increase in bulk. Nature has so arranged that, in the milk of the mother, every three or four ounces of the solid particles of that fluid, shall supply one ounce of nitrogenous material. When we compare this result, which is a fact independent of all theoretical considerations, with the condition of the class of starches at the close of the table,—known under the names of arrow-root, tapioca, and sago,—we see, that to supply these to children, would be to deprive them of the possibility of obtaining the requisite nourishment demanded by the wants of their systems. Since to communicate one ounce of nitrogenous matter to them, it would be necessary that they should swallow 26 ounces of starch, a proceeding which upon mechanical considerations alone would be impracticable. Beans and peas have been found much more effective in supporting the strength of animals subjected to hard labour, than grass or other soft fodder; and the reason for this on the principles under review are obvious. A cow weighing about 1000 pounds was found to introduce into its system 15·28 pounds of the solid portions of grass daily; but this was extracted from 100 pounds weight of fresh grass, and contained 1·56 pound only of nitrogenous matter, and 13·1 of heat-forming or respiratory food. To convey this large mass of nutriment into the stomach required the action of the primary organs of digestion during the whole day. While to have introduced a similar amount of nitrogenous matter in the shape of beans, not above 20 pounds would probably have been necessary. Thus by substituting the concentrated form of beans for the bulky grass, a great saving of time is effected in conveying the digestive materials into the current of the blood. The bulky nature too of grass,—from 100 lbs. of which only 15½ pounds of nutritive matter can be extracted,—affords an explanation of the more complicated nature of the stomachs of ruminant animals than of the human family, which practical experience, or instinct as some would term it, has taught to select more concentrated forms of food.

The primary and original food of man, whatever speculators may say to the contrary, is milk, a fluid of purely animal origin. If those who are to regulate diet are not guided by scientific knowledge, and do not exercise their judgment, they might be inclined to draw from this fact the inference, that the proper nutriment of man is animal food. This deduction might be defended with some show of reason to the exclusion of a vegetable diet. But observation having proved that animals can subsist upon a vegetable as well as upon an animal regimen, and scientific research having satisfactorily demonstrated that the constituents of the two kinds of nutriment, when well selected, are identical, the one-sided position must yield to the light of knowledge.

It will be now from these details, in some measure, understood how it happens that for all conditions of society, vegetable food may not be advisable ; and that vegetarianism, while it may be applicable in some instances, would be prejudicial in other individual cases. The poetical and merciful sympathies of Pythagoras it is impossible altogether to set aside, although it is unnecessary to echo the sentiment that "the man of cultivated moral feeling shrinks from the task of taking the life of the higher grade of animals, and abhors the thought of inflicting pain and shedding blood;" for even the Greek philosopher, although he objected to slay cattle for the purposes of human food, sacrificed, in a fit of enthusiasm, without any compunction one hundred oxen in commemoration of his discovery, that a square on the hypotenuse of a right-angled triangle, is equal to the sum of the two squares on the base and the perpendicular. Indeed such a cruel result of a scientific discovery has appeared to his admirers so inconsistent, as to induce them to suggest that the oxen were made of wax. It is more probable that, as in modern times, other causes had tended towards a vegetarian conclusion. But his arguments may be heard: "Forbear mortals to pollute your bodies with abominable food. Wild beasts satisfy their hunger with flesh, although not all; for the horse, flocks, herds, feed on grass. But those which have a wild and cruel temper, Armenian tigers, angry lions, bears, and wolves rejoice in bloody food. What a wicked crime it is that bowels should be buried in bowels, and that one greedy body should fatten on another crammed into it, and that one animal should live by the death of another."—*Ovid, Metamorph. xv. 2.*

A practical application, of the law involved in the table, to the nourishment of horses will now be understood. If we represent the amount of muscle removed from the body of a horse to be 2 lbs per day, while the amount of food consumed in the production of heat is 12 lbs., it is obvious that to make up for this loss, we should never think of giving to the animal food containing 2 lbs. of albuminous or muscular matter and 52 lbs. of non-nitrogenous or heat-forming matter, such as sago; neither should we give a diet containing 2 lbs. of albuminous material and 22 of calorifiant ingredients, such as turnips; but we should endeavour to administer nourishment which contained as nearly as possible the ingredients which the animal's consumption required. This object would be nearly attained by the use of oats, which would give for every 2 lbs. of muscular material, 10 lbs. of heat-forming constituents; or by barley 2 to 14. A mixture then of the two grains would supply the nourishment required by the animal, or the same result would follow by the employment of beans and hay. The principle of the arrangement of the food being understood, the nature of the nutriment can be easily calculated for the different conditions in which the animal may be placed.

A continuous study of the table brings us to oatmeal, which constitutes even at the present day an essential element in the support of the Scottish peasant. Wheat is no doubt cultivated to a greater extent than formerly, in northern latitudes, but from the analyses which have been published, it appears to be an undoubted fact that the amount of nitrogen increases, within certain limits, in this species of the *Cercalia* as the plant advances from the equator. But one cause of the high nitrogenous position held by oatmeal is, that as it is usually prepared it retains much of the bran, which is rich in nitrogen; while in the predominant form of wheat-flour this ingredient is in a great measure removed. When, however, the bran is retained in the flour, as when the entire wheat-seed is ground up and not sifted, the superiority of the nutritious value of oatmeal over wheat-flour has not been demonstrated. The substance termed semolina in the table, consists of bruised wheat from the south of Europe, and corresponds with the manna croup of the north of Europe, and the soojee of India. Illustrations of the fatal effects of this practice have been afforded by feeding calves on sago, a form of farinaceous matter, as exhibited by the table, which is artificially disturbed in its natural equilibrium. For it will be remembered that arrow-root, tapioca, and sago, as they occur in commerce, are the starches of natural flours which have been washed by repeated applications of water, until they have been to a great extent deprived of their nitrogenous matter, and of their saline ingredients. Calves fed on this form of food, have been observed to become most ready victims to passing epidemics. (*Smith of Deanstone.*) For a brief period they seemed not to suffer, but on the approach of disease they were readily subjected to its action, and rarely recovered. The same reasoning will apply to the human species. For if a child were fed on milk entirely (its composition being 1 nutritive to 2 heat-forming, the proper blood salts), and thrive as nature intended it should do on this species of aliment, could we expect that the infant would be equally nourished, when a portion of this type of food, was replaced by arrow-root, containing 1 nutritive to 26 of calorifiant material, without any of the saline ingredients required to produce blood? To expect such a result would be opposed to experience and to all analogy. From the table we may infer that the food destined for an animal in full exercise, should range between

milk and wheat-flour, according to the nature and extent of the demands upon the system. Milk may therefore be employed with a certain amount of the cerealia with probable advantage. When the food is preserved by nature, by means of combining water as in succulent vegetables, from the severe effects of the vicissitudes of the atmosphere, the most efficient nutriment is afforded to the inferior animals. This is shown in the following table, where an average is given of the products of two cows, in milk and butter, by different species of aliment. The largest amount is obtained from grass, which preserves its equilibrium most firmly during the changes of the seasons, while hay and cereal crops from their want of succulence, and therefore of protection from the rain and fermenting influences, are less influential in effecting a steady product.

	Milk in 5 days. lbs.	Butter in 5 days. lbs.	Nitrogen in Food in 5 days. lbs.
1. Grass - - - -	114	3.50	2.32
2. Barley and hay - -	107	3.43	3.89
3. Malt and hay - -	102	3.20	3.34
4. Barley, molasses, and hay -	107	3.44	3.82
5. Barley, linseed, and hay -	108	3.48	4.14
6. Beans and hay - -	108	3.72	5.27

It had been found by experiment, that, not only in hay-making is the colouring matter of the grass removed or altered, but, particularly in moist districts, the sugar or heat-forming portion of this form of provender is washed out by the rains or destroyed by fermentation, while a certain proportion of the soluble salts absolutely required for the production of animal blood and milk is also removed by every shower which falls during the drying of the hay. In this table the butter and milk of the cow may be supposed to represent the increase of bulk which a growing animal sustains during its infant years; while the richness of these forms of dairy-produce are the well-recognised tests of the value of the soil and pasturage upon which the animals have browsed. By a comparison of the relation of the different kinds of cerealia we may improve one species by mixing it with another. By mixing 1-third of Canada flour with 2 thirds of Indian corn, a very good loaf is produced, and when equal parts of flour and oatmeal, or of barley, or of pea-meal are employed, a nourishing bread is formed. Beneficial results have also followed from the admixture of two or three different kinds of grain, and many of these forms of bread might be substituted with advantage for wheat flour in peculiar conditions of the system. The superior advantage of good wheat flour depends on the presence of gluten, an adhesive nitrogenous principle, which, during fermentation by the resistance which it presents to the escape of the carbonic acid, engenders that vesicular spongy condition which is considered the test of a good loaf. From the absence of this substance in other kinds of grain, they are of themselves incapable of affording a spongy loaf, and hence the presence of wheat flour is essential in all well-raised bread. A loaf may be made of equal parts of oatmeal and flour, which when fermented will be highly spongy. It is advisable in such a case to use foreign flour, which contains a larger proportion of adhesive gluten than is found in the wheat flour grown in our northern climate. It may be objected that the recommendation of such mixtures is a direct invitation to bakers to adulterate their flour. But such mixtures are admitted by law with the provision that the letter M be affixed by the baker to the loaf. Indian-corn bread may be baked of good quality by a smaller admixture of flour than is necessary when oatmeal is the other ingredient. For this purpose it should be reduced to a fine meal, in smaller particles than is practised in the United States. It may then be mixed with one-third its weight of best flour, and be fermented in the usual way. When thus baked, the best Indian-corn bread is always dark coloured, and cannot be made much lighter than coarse wheat bread. The shade of colour is yellowish. When Indian corn bread appears white, the conclusion to be drawn is that the mixture consists of more than one-third of wheat flour. Even when one-half its weight of wheat flour is added to it, Indian corn exhibits in the mixture its characteristic dark tint. See BREAD. The position which potatoes hold in the nutritive scale, shows that although they are frequently used in the mode of preparing bread by fermentation, no advantage would be gained by augmenting their amount, since the aliment would thus be rendered more dilute and the statement of the poet confirmed:—

“Bread has been made (indifferent) from potatoes.”—*Byron*.

At the present day the New Zealanders are affected, to the extent, in some districts, of 20 per cent., in others of 10 per cent., with external marks of scrofula, a fact which was not observed by Capt. Cook. This disease is therefore inferred to be a modern innovation, brought about by the natives having lived since Cook's time on potatoes, which have superseded fish and pig's flesh in a great measure. It is only necessary

to see a child after a month's residence in the house of a European, to have an indication of the magic influence better diet would have on the whole race. The puny limbs of the young savage grow stout, the protuberent belly disappears, and traces of red blood can be seen through the nut-coloured skin of his infant face.—*A. S. Thomson's New Zealand*, i. 216.

Further support of the law enunciated has been afforded by subsequent experiments (*Fresenius, Knapp, Playfair, Liebig*). "A glance at these relations is sufficient to convince us that in choosing his food (when a choice is open to him), and in mixing the various articles of diet, man is guided by an unerring instinct which rests on a law of nature. This law prescribes to man as well as to animals a proportion between the plastic and non-nitrogenous constituents of his whole diet, which is fixed within certain limits within which it may vary according to his mode of life and state of body. This proportion may, in opposition to the law of nature and instinct, be altered beyond these limits by necessity or compulsion, but this can never happen without endangering the health and injuring the body and mental powers of man. It is the elevated mission of science to bring this law of nature home to our minds; it is her duty to show why man and animals require such an admixture in the constituents of their food for the support of the vital functions, and what the influences are which determine in accordance with the natural law changes in this admixture." (*Liebig, Fam. Letters on Chemistry*, 1851, p. 362.) It has been shown that when a French soldier is fed on 1 lb. 10½ oz. of bread, he consumes in this ration 1 part of nitrogenous to 4¾ of non-nitrogenous material (*Knapp*), and that when pigs were fed on potatoes no augmentation could be detected in their weight. An increase was observed when the diet of the animal was potatoes, butter-milk, whey, and kitchen refuse, but the greatest improvement took place under what was termed a fattening fodder, consisting daily of 9·74 lbs. potatoes; ground corn, 9 lbs.; rye-meal, ·64 lb.; peas, ·68 lb.; butter-milk, whey, and kitchen refuse ·92 lb. (*Boussingault*). In these different modes of dieting, the following were the relations of the constituents of the food:—

	Nitrogenous.	Non-Nitrogenous.
Potatoes - - -	1	to 8¾
Mixed food - - -	1	„ 7½
Fattening fodder - - -	1	„ 5½

The German farmer renders the proportion more nearly allied, between the proximate principles of the potato, by fermenting and distilling from them a spirit, and giving the residue thus supplied with a less proportion of heat-forming material to his cattle. It has been supposed in other countries that the German agriculturist is a distiller. On the contrary the production of spirit is a result of what he has found to be by experience, a valuable method of improving the alimentary character of the potato (*Knapp*). All of these explanations have been deduced since the law of the equilibrium of the food detailed above was detected.

The following tables are illustrations of the same law:—

	Weekly Con- sump- tion.	Nitro- genous Matter.	Non- nitro- genous Matter.	Mineral Consti- tuents.	Carbon.	Relation of nitro- genous to non- nitro- genous Matter.
	Grms.	Grms.	Grms.	Grms.	Grms.	As 1 to
DIETARIES OF SOLDIERS AND SAILORS.						
English soldier - - -	11703	1119	3937	152	2219	3·50
„ „ in India - - -	9080	1057	3195	74	2053	3·02
„ sailor (fresh meat) - - -	9350	1078	3185	98	2184	2·95
„ „ (salt meat) - - -	8978	1274	4092	187	2706	3·69
Dutch soldier, in war - - -	6130	1090	3160	57	2293	2·90
„ „ in peace - - -	11857	759	3306	128	2191	4·35
French soldier - - -	10742	1029	3955	143	2639	3·84
Bavarian soldier - - -	7492	652	3161	103	1933	4·85
Hessian soldier - - -	13096	712	4210	-	2384	5·91
DIETARIES OF CHILDREN.						
Christ's Hospital, Hertford - - -	6687	531	1897	76	1213	3·57
„ „ London - - -	7488	534	2378	88	1453	4·45
Chelsea Hospital boys' school - - -	7585	401	2888	183	1785	7·20
Greenwich Hospital „ - - -	7151	570	2685	81	1637	4·71

	Weekly Con- sump- tion.	Nitro- genous Matter.	Non- nitro- genous Matter.	Mineral Consti- tuents.	Carbon.	Relation of nitro- genous to non- nitro- genous Matter.
	Grms.	Grms.	Grms.	Grms.	Grms.	As 1 to
DIETARIES OF AGED PERSONS.						
Greenwich pensioners - - -	8328	757	3784	109	2242	4·87
Chelsea " - - -	10278	905	3487	144	2416	3·85
Gillespie's Hospital, Edinburgh -	4829	651	2858	73	2210	4·39
Trinity Hospital " -	5944	608	3014	104	1774	4·95
DIETARIES OF AGED POOR.						
1st class - - - -	-	626	2743	101	1681	4·38
2nd " - - - -	-	463	2773	89	1582	5·99
3rd " - - - -	-	488	3092	121	1716	6·33
4th " - - - -	-	595	3617	123	2101	6·08
5th " - - - -	-	479	2988	111	1694	6·24
6th " - - - -	-	454	2725	88	1535	6·00
Mean of all English counties - -	-	681	3065	-	1796	4·50
St. Cuthberts', Edinburgh - -	5418	458	2766	102	1454	6·04
City poorhouse " - -	3312	412	1547	54	975	3·75
DIETARIES OF ENGLISH PRISONS.						
2nd class, above 7 not above 21 days -	6393	472	3463	107	1834	7·34
3rd " 21 " 6 weeks' hard labour - - - -	9144	565	3827	125	2091	6·77
4th, 7th, 8th classes, above 6 weeks' not above 4 months' hard labour -	8405	649	3900	156	2162	6·00
5th class, above 4 months' hard labour - - - -	10092	628	4042	131	2270	6·43
BENGAL PRISONS.						
Without labour - - - -	6935	571	5051	64	2364	8·85
With labour - - - -	9464	872	5917	92	2819	6·78
Contractor's insufficient diet - -	5185	393	4209	40	1899	10·71
BOMBAY PRISONS.						
All classes, without hard labour -	5634	867	3142	63	2130	2·08
With hard labour - - - -	6935	1103	3987	76	2800	3·61
ARCTIC AND OTHER DIETARIES.						
Esquimaux - - - -	-	7740	39628	-	34830	5·12
Yacut - - - -	-	3093	19814	-	29907	6·46
Boschesmen - - - -	-	1777	11393	-	17182	6·41
Hottentots - - - -	-	1323	12384	-	18699	9·36
Farm labourers, Gloucestershire -	5065	825	3299	34	2323	3·97
" Dorsetshire - - -	3548	631	2243	36	1601	3·55
" Dharwar, Bombay						
— return in Bombay Prison Dietaries - - - -	6749	434	4280	77	1905	9·86

In these tables the ounces of the original are calculated as grammes, and the last column gives the relation of the nitrogenous or flesh-forming part of the food, to the non-nitrogenous or heat-producing ingredients of the aliment, instead of, as in the original, the proportion between the carbon of these constituents of the food being estimated. The table is read thus:—an English soldier consumes weekly 11,703 grammes (a gramme equal to 15·44 grains) of food. In this food 1119 grammes are nitrogenous or flesh-forming matter; 3937 non-nitrogenous or heat-producing material; 152 mineral substance; the organic matter containing 2219 grammes carbon. The relation of the nitrogenous to the non-nitrogenous matter is as 1 to 3·50. From this table the results have been deduced that soldiers and sailors consuming 35 ounces of nitrogenous or flesh-forming food weekly, and 70 to 74 ounces of carbon, the proportion of the carbon in the flesh-forming, to that in the respiratory or heat-forming

food, is as one to three. Older persons require only 25 to 30 flesh-forming matter weekly, and from 72 to 78 respiratory food; the relation of the carbon in these is as 1 to 5. Boys of from ten to twelve years of age require 17 ounces of flesh-forming matter, the relation of the carbon in the flesh-forming to the heat-producing aliment being as 1 to $5\frac{1}{2}$. In workhouses and jails, less heat-producing matter is consumed, in consequence of the shelter and heat supplied artificially to the inmates. In prisons, where hard labour is in force, the consumption of flesh-forming or nitrogenous nutriment increases. It has been estimated that in a man weighing 140 lbs., the weight of the flesh-forming matter of the blood is 4 lbs., that of the muscular tissue $27\frac{1}{2}$ lbs., and in the bones 5 lbs., making a total of $36\frac{1}{2}$ lbs.; and that in the course of 18 weeks these $36\frac{1}{2}$ lbs. are introduced into the system. (*Playfair New Edin. Phil. Journal*, 1854, 56, 262.) The author of this elaborate and valuable table has justly remarked that the old mode of estimating the value of dietaries, by merely giving the total number of ounces of solid food used daily or weekly, and quite irrespective of its composition, is most erroneous; and he quotes an instance of an agricultural labourer, in Gloucestershire, who, in the year of the potato famine, subsisted chiefly on flour, consuming 163 ounces weekly, which contained 26 ounces of flesh-forming matter. When potatoes became cheaper, he returned to a potato diet, and now ate 321 ounces weekly, although they contained of true nutriment only about 8 or 10 ounces. A comparison of the six pauper dietaries formerly recommended, with the difference between the salt and fresh meat dietary of the sailor, &c., have no relation in equivalent nutritive value, but merely rely on absolute weight alone. It is by such dietaries, where the proper balance of the constituents is not preserved, that, although the appetite may be satisfied, the waste of the system is not adequately repaired. The health may appear not to be affected in the absence of epidemics, but, under such a dietary as that alluded to, a maximum of labour cannot be obtained from a workman; a frail constitution is engendered, which acts as a fertile soil to miasmata of various kinds. These seeds of disease taking root, are rapidly developed into maladies, like the rank fungi of damp and dismal cellars.

When the constitution of the food is compared in its relations of muscular to fatty matter, with the proportion of these ingredients deposited in animals, the result is of interest. Carefully conducted experiments on the large scale upon animals have shown that in fat animals killed and carefully analysed after death, the carcass of the fat ox contained 1 part of nitrogenous matter to $2\frac{1}{3}$ fat; in that of the fat sheep the relation was 1 to 4; in that of the very fat sheep, 1 to 6; and in the moderately fat pig, 1 to 5. In the lean sheep the proportion was 1 to $1\frac{1}{2}$; in the lean pig 1 to 2. The average composition of such well fattened and lean animals was found to be nearly

				Fat animal.			Lean animal.
Nitrogenous matter	-	-	-	12·5	-	-	12·87
Fat	-	-	-	33·	-	-	25·3
Mineral matter	-	-	-	3·	-	-	4·5
Water	-	-	-	51·5	-	-	57·33
				100·			
							100·

It was found by an analysis of some of the most important animals fed and slaughtered as human food, that the entire bodies, even when in a reputed lean condition, may contain more dry fat than dry nitrogenous substances. Of the animals ripe for the butcher, a bullock and a lamb contained rather more than twice as much dry fat as dry nitrogenous matter. While in a very fat pig and sheep, the proportion was 1 muscular matter to 4 fat, and in a moderately fat sheep the fat was three times greater than the nitrogenous matter.—*Lawes and Gilbert, Proc. Royal Society*, No. 32,348—June, 1858.

Use of fermented liquids in nutrition. — In the very earliest periods of human history wine appears to have been known, and to have been of the same nature with that which we now use, as the Hebrew term employed to designate the stimulating liquor indicates it as being derived from a fermenting origin (*Pareau. Antiq. Heb.* 396). This, together with its wide spread use, has frequently been considered as an argument in favour of its necessity. But its ubiquity cannot be substantiated. The native Indians of North America, amounting to some millions in number, were unacquainted with fermented products until they were visited by the white man (*Catlin*). When the Spaniards first visited South America, they were astonished at the constitutional temperance of the natives, which in their opinion, far exceeded the habits of the most mortified hermits (*Robertson*, iv.). In Patagonia, within the last 200 years the inhabitants when offered a bottle of brandy would not drink (*Sir J. Narbrough*, in 1669, 8vo. 1711, p. 50). If we refer to Africa, we have the authority of the great traveller

who has penetrated into the interior of that mysterious continent, that true to their faith, the Mohammedans "drink nothing but water" (*Park*), and it is only among the Pagan negroes who have frequent intercourse with the coast in consequence of these being the reservoirs from which slavery emanates, and in such semi-civilised towns as Tripoli, that religion is placed in subjection to inebriating indulgences, and that "drunkenness is more common than even in most towns in England" (*Lyon*). It is true that the ancient Gauls and Germans who, however, were somewhat civilised, made use of beer, but whether they did so habitually, or to excess, before they were contaminated by Roman customs, seems unlikely. Certain it is that they had no wine of their own. The Gauls purchased their wine chiefly from Italy, and were exceedingly fond of it (*Diodorus*), and hence they are said to have been invited into that country by the delicacy of the Italian wines (*Livy*, v. 33). Even among the Romans however, in the virtuous days of the Republic, strong drinks were not universally in favour, since it was fashionable in order to make wine keep, to boil it down to one half (*Virgil*), or one third (*Pliny*), in other words, to distil away all the alcohol it contained. All the circumstances, indeed, with which we are acquainted seem to support the view of the historian that, "it is in polished societies where intemperance undermines the constitution" (*Robertson*). These facts seem to prove that alcohol is not a necessary of life. It remains to consider what its influence is upon the system. When fluids containing alcohol are introduced into the body of animals, the amount of carbonic acid evolved from the lungs speedily begins to diminish. The influence of even a small portion of wine begins to be appreciable in a very short space of time after it has been swallowed, so that we infer its power in this respect to be almost consentaneous with its arrival in the stomach. Alcohol itself possesses a similar effect, and the use of porter is attended by the same results. Numerous experiments have demonstrated that alcohol in every state, and in every quantity, uniformly lessens, in a greater or less degree, the quantity of carbonic acid elicited according to the quantity and circumstances under which it is taken. When taken on an empty stomach, its effects are remarkable; the depression is greatest almost instantaneously; after a short time, however, the powers of the constitution appear to rally, then it sinks again, and afterwards slowly rises to the standard. That the action of the alcohol in these cases depends on its influence on the nervous system, and not on its chemical action, is obvious from the fact that strong tea acts in a similar manner, and with the same degree of rapidity; three ounces of strong tea in five minutes after being swallowed depresses the amount of carbonic acid progressively (*Prout* 1813). Other experiments bear testimony to the wonderful effect of alcohol on the nervous system. Two ounces of alcohol when injected into the stomach of a rabbit, rendered it immediately insensible, just as if the animal had been violently struck on the head. Two drachms placed in the stomach of a cat, instantly made it struggle violently and fall on its side perfectly motionless and insensible. It is remarkable, too, that the effects of alcohol, and of injuries, more particularly concussion of the brain, so closely resemble each other, that the most accurate observer cannot often distinguish them, except from the history of the case (*Sir B. C. Brodie*). When alcohol is introduced *in excess* into the system, the arterial blood appears to retain the venous condition, and thus asphyxia may be produced (*Bouchardat*). Alcohol it is affirmed, has been detected in small proportion in the air exhaled from the lungs, and also in the blood of drunkards, while a considerable portion of acetic acid, one of the products of its combustion, has been observed in the blood after the use of this fluid (*ib.*). These views, therefore, tend to the conclusion that alcohol, in all its forms, produces an alteration in the usual phenomena consequent upon digestion; that this influence is analogous to that of those causes which produce depression of the nervous centres, and therefore its employment by preference as a heat-supplying agent to the animal system in cases of health, is a procedure involved in very great doubt. The argument in favour of the calorifiant nature of alcohol is, that as it disappears in the system it acts as an element of respiration, and although its constituents do not possess by themselves the property of combining with oxygen at the temperature of the body, and forming carbonic acid and water, yet it acquires, by contact with bodies susceptible of this combination, this property in a higher degree than fat, &c. (*Liebig*). If then alcohol be thus capable of conversion into carbonic acid and water with facility, how are we to explain the fact that alcohol diminishes the amount of carbonic acid in the expired air? The answer has been that as alcohol contains a large amount of hydrogen, which by union with the oxygen of the air, passes off from the lungs in the form of vapour of water, the diminution of carbonic acid is a necessary result of the use of this stimulant. But there is a remarkable fact which appears to throw doubt on this view, viz. that in addition to the analogous and instantaneous action of tea, as long as the effects of alcohol are perceptible to the feelings of the in-

dividual who has swallowed it, the quantity of carbonic acid is *below* the standard. The effects of drinking go off with frequent yawnings, and with a sensation as if awakening from a sleep. Under these circumstances the quantity is generally *much above the standard*, and hence it would seem that the system is freeing itself from the retained carbon (*Prout*). The phenomena of yawning, sighing, &c., appear to have evidently the effect of throwing off a quantity of carbonic acid retained in excess in the system, since sleep and depressing passions seem to operate by diminishing the amount of carbonic acid. There may be various reasons, too, for inferring that alcohol is not thrown off in the form of colourless, odourless, gases by the lungs. The offensive ethereal smell retained in the breath of the drunkard for many hours after the introduction into the stomach of the cause of his inebriation, seems to favour the view that other products besides carbonic acid and the vapour of water result from the use of alcohol. That alcohol does not occupy a very high position as a calorifiant agent, is evident from its comparative operation in heating the body when cooled and depressed by external cold.

Hot fluids are familiarly known to all to be much more efficient in raising the heat of the body, than *raw spirits* or *strong fermented fluids*, which have a depressing action unless combined with hot fluids. The influence of the use of spirits has been tested in the army, and it has been found in India, that when a regiment consumed from 10,000 to 14,000 gallons, the mean annual mortality was 76, and when the amount was reduced to 2000 to 3000, the mortality fell to 24, out of the same strength. An interesting experiment has been in operation during the last 20 years in the United Kingdom Provident Institution. During that period this society has insured a distinct section of abstainers who number above 5000, and it has likewise a more numerous section of the general public. During the first 6 years, out of 2060 members only 18 died, equivalent to a loss of .9 per cent., while the office of the Society of Friends, who are distinguished for their care of health, lost in the corresponding period of their history 3.3 per cent. The most recent report from this institution after 15 years' existence, gives a return of 19 per cent. of profits in favour of the abstainers, over the section of non-abstainers; although that division likewise contains many individuals of the latter class.

Influence of tea and coffee in nutrition.—The experiments already referred to indicate that tea delays the regular changes of the body of animals, since the carbonic acid exhaled from the lungs declines in quantity under the influence of tea. (*Prout*, 1813.) Coffee, from its containing the same principle, might be inferred to be possessed of a similar action, and this has been found to be the case; but it has been found, in addition, that a decoction of coffee communicates greater activity to the circulation and nervous system. The delay which it effects in the metamorphosis of the tissues appears to be occasioned by the empyreumatic oil of the berry, which likewise produces increased action of the sweat pores, of the kidneys, and an accelerated motion of the intestinal canal; while the effects of caffenin in excess are increased activity of the heart, headache, delirium, &c. (*Lehmann*, 1853.) Coffee and tea, as usually employed, appear therefore to act as stimulants and as agents by which the conversion of the solids of the body into soluble and gaseous products is considerably delayed. Their influence is analogous to that of alcoholic fluids when these are taken in moderate quantities, although there is no evidence that they are capable of producing organic disease, such as inevitably attends the consumption of increased doses of alcoholic fluids. The Turcomans employ tea in their wanderings as an article of nutriment, and have discovered by long experience, what has been confirmed by chemical research, that the leaves of tea contain a large amount of nitrogenous matter, which is not however dissolved in the usual process of infusion. One ounce of tea leaves and an equal weight of carbonate of soda are boiled by the Turcomans in a quart of water for an hour. The liquor is then strained and mixed with ten quarts of boiling water, in which an ounce and a half of common salt have been previously dissolved. The whole is then put into a narrow cylindrical churn along with butter, and well stirred with a churning-stick till it becomes a smooth, oily, and brown liquid, of the colour and consistence of chocolate, in which form it is transferred into a teapot. (*Moorcroft*.) The soda has the effect of taking up the cassein or curd, a most nutritive nitrogenous compound, and which is present in large quantity.

Influence of tobacco and opium on nutrition.—It has been observed in favour of the practice of smoking tobacco, that even the most primitive tribes indulge in this practice. If it were a correct observation, the practice may be pronounced to be a savage one, and to be connected with the conditions of savage life. The North American Indians all smoke, but when uncontaminated by intermixture with the whites, tobacco is unknown to them. The material which they employ is the prepared bark of a species of willow. The presence of such products of combustion in the system

appear like tea and coffee, which have also been discovered in primitive nations to delay the degradation of the tissues and husband the food. The American Indians, who live entirely upon animal food, and who have impressed on them a restless and wandering existence, from the nature of their food, — from the difficulty experienced in obtaining animal heat, — from the metamorphosis of the nitrogenous tissues, — use the smoke of vegetable matter to make their food last longer. Tobacco and opium when smoked appear to have a similar action, but they likewise influence the nervous system and occasion a stimulating influence, which is apparent in the vivacity of the eye, particularly with opium as it is smoked in China. The practice of opium eating, as in use among the Turks and the islands of the Indian Ocean, is totally distinct in its physiological results; a wild inebriety being often produced, which, if persisted in, conducts to a lamentable end. In a case which occurred to us the liver was entirely destroyed by fatty degeneration.—R. D. T.

NUX VOMICA; *Strychnos nux vomica*, Linn. The seeds of a tree growing in Coromandel and other parts of India and Ceylon. From these strychnine is obtained. See **STRYCHNINE**.

Nux vomica bark was at one time confounded with Angustura or Cusparia bark, and serious consequences might have ensued by that, the error was discovered in time. It is now rarely seen.

In 1857 our imports of the nux vomica seeds amounted to 1,085 cwts.; but in the same year we exported 1,195 cwts., the excess being of course derived from the importations of former years.

O.

OAK. (*Chêne*, Fr.; *Eiche*, Germ.) This well-known European tree is so familiar that it scarcely requires any description. The varieties generally known in England are the

Quercus pedunculata, Common Oak, which is a native of Britain, and is largely employed in building ships.

Quercus ilex, Evergreen Oak. This tree is not a native, but has been cultivated in Britain from the most remote period.

Quercus cerris, Turkey Oak. Introduced into this country more than a century since.

Quercus coccinea, Scarlet Oak. The leaves changing with the first frosts to a brilliant scarlet.

Quercus sessiliflorus, Common short stalked Oak. This is said to excel for building purposes any other oak.

OAK BARK. The oak tree is generally barked from the beginning of May to the middle of July. The barkers make a longitudinal incision with a mallet furnished with a sharp edge, and a circular incision by means of a barking bill. The bark is then removed by peeling irons, the separation being promoted when necessary by beating the bark. It is collected and stacked in pieces about two feet long. Oak bark contains, according to Braconnot, tannic acid, tannates of the earths, gallic acid, pectin and lignin. Davy, in his *Agricultural Chemistry*, gave the following as the relative quantities of tannin contained in oak bark:—

480 lbs. of entire bark of a middle-sized oak cut in spring	-	29 lbs.
„ „ coppice oak	- - - - -	32 „
„ „ oaks cut in autumn	- - - - -	21 „
White interior cortical layers	- - - - -	72 „

See **TAN**, **TANNING**.

OAK, BOG. Oak trees, which have been buried for a long period in peat bogs, become intensely black; and in this condition the wood is employed in the manufacture of furniture and articles of ornament, especially in Ireland.

OAK, DYER'S. See **GALL NUTS**.

OATS. (*Avoine*, Fr.; *Hafer*, Germ.) The oat is extensively cultivated in these islands, especially in Scotland. In fact, Scotland is the country admittedly the best fitted for the growth of oats. The estimated number of acres of cultivated land in Scotland is 2,400,000, of which 220,000 are under wheat, 280,000, under barley, and 1,270,000 under oats.—Lawson's *Vegetable Products of Scotland*.

Mr. J. P. Norton, in Silliman's *American Journal*, has published an account of a most complete investigation of oats in the various stages of their growths. He gives the following as the result of his analysis of *Hopeton oats*:—